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ABSTRACT

Motivational psychology and test theory are compared in this discussion, which focuses on distinguishing the effects of motivation and of ability on test performance and educational achievement. Recent theory in achievement motivation considers the motivational significance of future goals as they affect present activities that are instrumental in attaining the future goal. Motivation influences behavior in two ways. First, it controls the way an individual allocates time among different activities. Secondly, the strength of motivation influences the efficiency of performance in a way that is most simply described by an inverted U-shaped curve. Large scale studies of this effect on student performance on ability, intelligence, and aptitude tests are needed. Motivational theory may account for two current phenomena: the decline in college entrance examinations scores, at the same time that college grade point averages are rising. Motivation to attend college peaked in the late 1960's, and declined between 1972 and 1975, when job prospects after graduation appeared to be limited. Current college students are very much grade-conscious, and face stiff competition. Today's students may be both more able and more highly motivated than ever. Systematic experimental study by the testing agencies is needed. (GDC)

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Theory and Motivational Psychology

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The title is more general than the talk. It identifies a confrontation between two ways of thinking about the very same behavioral phenomena that has been going on for some time. But now motivational psychology has caught up with test theory in the clarity, completeness, and coherence of a mathematical model of motivation and action called the dynamics of action (Atkinson and Birch, 1970; 1974; 1978). The next decade should produce a new understanding of the proper relationship between test theory, which is grounded in statistical considerations, and the new theory of motivation, which is grounded in more than a quarter of a century of research on the problem and psychological considerations.

After a few introductory remarks, my discussion will focus on one aspect of the confrontation: distinguishing the effects of motivation and ability on test performance and educational achievement.

The most lasting contribution of all the work that has been done on achievement motivation is the way in which it is changing our ideas about how motivation influences behavior. The early work helped us to recognize that individuals may react in diametrically opposite ways in situations demanding competent performance. Those who are highly motivated to achieve are challenged. Those who are more fearful of failure are threatened. And we soon came to recognize that the difficulty of the immediate task was an important situational factor controlling the arousal of achievement-related motivation (Atkinson and Feather, 1966). More recently we have come to appreciate the reality of the paradox of fear of success in women (Horner, 1974). And Raynor (1969, 1974) has given us a more general theory of achievement motivation by including, in his broader conception, the motivational significance of more distant future goals anticipated when one views present activity as instrumental to their attainment.

I think much of this is familiar. There remains, however, a deplorable gap between what we are learning at the frontier of research in motivational psychology and the way we are thinking about the role of motivation in mental testing and educational achievement. (Atkinson and Raynor, 1974, 1978).

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The most recent theoretical development (Atkinson and Birch, 1970, 1974, 1978) has, for example, allowed us to demonstrate by means of computer simulation of the problem that the validity of thematic apperceptive measures of individual differences in motivation does not depend at all on internal consistency or reliability as traditionally conceived (Atkinson, Bongort & Price, 1977). That answers a persistent criticism of our methodology (Entwisle, 1972). And it defines one confrontation involving contemporary theory of motivation and traditional test theory. Today, in the brief time available, I will discuss another confrontation of motivational psychology and traditional ideas about tests. We must close the deplorable gap between the frontier of research in motivational psychology and discussion of vital issues in education. Their social significance will not tolerate the normal ten to fifteen year gap in communication from the frontier of science to textbooks concerning applications.

I hope to persuade some educational psychologists that two generalizations based on experimental and conceptual analysis of how motivation influences behavior provide a new basis for comprehending the meaning of declining trends in test scores and the merely modest predictability of educational achievement from tests of "scholastic aptitude", and other problems involving the utter confounding of differences in ability and differences in motivation.

Motivation influences behavior in two ways. First, the strength of motivation for one kind of activity relative to the sum of the strengths of motivation for other, alternative activities within an individual determines that individual's allocation of time among different activities (Sawusch, 1974).

This generalization concerning the determinants of percentage of time devoted to one kind of activity, such as academic work, as I have stated it non-technically, is the most important theoretical conclusion drawn from the re-construction of the theory of motivation by David Birch and myself in The dynamics of action (1970). We have confidence in it for several reasons. It has been sustained in computer simulations of motivation and behavior based on the new principles of motivation (Atkinson, Bongort, & Price, 1977), and it corresponds in form exactly to the "matching law" proposed by deVilliers and Herrnstein (1976) to summarize what is known about the antecedents of the relative strength of competing activities in many studies of operant conditioning. One merely needs to continue to remember what E. L. Thorndike proposed in the Law of Effect, that the inclination to undertake rewarded actions is strengthened, to employ the dynamics of action as a theory of operant behavior.

The theoretical conclusion is shown in the hatched curve of Figure 1. For simplicity, here, I will treat the relationship as linear as shown in the solid curve.

[Insert Figure 1 near here]

In addition to controlling the way an individual distributes the time of his or her life among different activities, the strength of motivation expressed in the performance of some activity influences the efficiency of performance nonmonotonically, in a way that is most simply described by an inverted U - shaped curve. There has been evidence of this in research with animals since the time of Yerkes and Dodson (1908; e.g. Bir[illegible], 1945; Broadhurst, 1959). And it has long been a well-known generalization concerning level of arousal in neurophysiological research (Hebb, 1972). In recent years (Eysenck, 1966; Atkinson, 1974) there has been convergent evidence from studies of human motivation employing both valid measures of individual differences in motivation and experimental manipulation of incentives to be attained as a consequence of good performance.

[Insert Figure 2 here]

The implications of this second generalization are shown in Figure 2. Unless one assumes that individuals do not differ in strength of motivation when taking some test traditionally called an intelligence-ability- or scholastic aptitude test, or that strength of motivation has no influence on efficiency of performance, one must consider the several curves in Figure 2 B as the most tenable description of the traditional confounding of effects of differences in ability and of strength of motivation on the level of intellective performance as recorded by a test score. One may note that there are three ways to score 100 on the hypothetical test. One may combine a true level of ability of 100 with optimal, that is, moderate strength of motivation on test day which makes for maximal efficiency at the time.

One may be more able (level 125) and either undermotivated, e.g., dampened by the dread of failure or deficient in strength of positive motives and consequently less efficient. Or one may combine that same higher level of true ability with such strong motivation to perform well that there is inefficiency attributable to overmotivation, overexcitement.

I would not propose this interpretation of the level of intellective performance on tests such as Scholastic Aptitude tests if we did not have considerable evidence of it in experiments on verbal and arithmetic performance among college students. What is needed, of course, are definitive large scale studies using the tests that are conventionally called intelligence-ability-or aptitude tests but including the tools available to categorize individuals according to differences in motivation and also employing the techniques available for manipulation of the incentives or of intensifying motivation in other ways at the time of performance (see Raynor 1969, 1974, 1978).

[Insert Table 1 here]

Table 1 puts the two generalizations about motivation into an analysis of how nine students who differ in true ability and in strength of motivation would perform in a critical ability test situation (left side of the table), and how much they would achieve academically in the long run (on the right side of the table).

Consider test performance first. It is assumed that each student spends all the time available working on the test. The level of performance (or test score) is the product of ability and efficiency. The latter is optimal when strength of motivation is moderate as shown in Figure 2.

Now consider cumulative achievement under normal everyday conditions. Here we assume that intensity of motivation is generally less than in a stressful test for all students (1 unit less for simplicity). This change in motivation has an influence on the efficiency of performance in day to day work. Note that subject A3, the superstar on the big test, is now somewhat less than optimally motivated, less efficient, and the level of performance when at work is therefore lower than when taking a test. Note that A4, the very able student who is overmotivated on the test is now optimally motivated and therefore more efficient. What is more, he or she is still relatively more strongly motivated than others and these individual differences in motivation are expressed in the amount of time spent in academic work.

The presumption concerning cumulative achievement, which is evaluated in the grade point average over a long period of time, is that it is the product of the level or quality of performance while at work and the amount of time spent at work. Note that A4 achieves most in the long run, and that A3, the test-taking star, is well down in the distribution on cumulative achievement. One is called an overachiever, the other an underachiever. (Thorndike, 1963).

In more elaborate analyses of this sort, including more of a range of differences in ability and of motivation and variation in the number and strength of competing interests which also, you recall, will influence percentage of time spent in the critical activity, we have found that the linear correlations between hypothetical so-called ability test scores and cumulative achievement consistently falls between .30 and .50 just where the correlation between college aptitude test and grade point average in college traditionally falls in the studies conducted by the major test agencies (Angoff, 1971; The American College Testing Program, 1973).

In brief, we can deduce one of the best documented facts in mental testing by simply applying what is known about the effects of motivation on behavior to the problem.

Consider two other current phenomena that are being widely discussed: the decline in test scores of college aspirants in recent years at the very same time that grade averages in college have been on the rise.

The implication of the report of the prestigious commission to explain the decline in test scores (College Board, 1977) produced a number of vague and mouselike conclusions from (presumably) a mountain of considerations. Somehow, and unfortunately because it defines the gap between behavioral science and agencies that should be in contact with it, the report of the commission did not even mention the possibility of decrements in intellective performance attributable to overmotivation. Rather, the general impressions followed conventional wisdom. Students today are probably dumber and less motivated than before; the schools are inept. These are widespread opinions about younger people, in every generation I might add, and about schools which seem always to be misusing the hard-earned tax dollars.

The conclusion about the rise in grade averages is called "grade inflation" and attributed to the lack of spine in professors. This is another popular opinion, even among professors-about other professors.

Look back at Table 1 with another hypothesis in mind, one that takes into consideration some factors that might, conceivably, have intensified motivation. The 1960s was marked by liberation of blacks, of women, a war that young men could avoid only by getting into college, an increase in the percentage of highschool graduates going to college that peaked in 1969 at more than twice what it was in the 1950s, persistent reminders on television that the only way to make it in life was to hang in there and get a college education. Then came the big recession from 1972 to 1975, and the torrent of information about limited future job prospects in this, that, and the other field, you name it.

Is it unreasonable to presume that students taking the college aptitude tests might have confronted that critical situation with a much more explicit sense of the importance of getting a high score, of the instrumental relationship between that test, their subsequent college performance, and achieving their own personal goals in life? And what about a greater awareness of intensified competition for college admission because the pool of aspirants for challenging careers had now been expanded to include all racial groups and women? I don't find the hypothesis of stronger motivation unreasonable. It was my impression when the movement to pass/fail was initiated and it has been sustained by my day-to-day contact with anguished, grade-conscious college students ever since. Today's students are grinds.

We know from Raynor's program of research that future orientation (that is, perceiving success in the immediate task as instrumental to attainment of future goals) <u>intensifies</u> motivation.

So look at Table 1 with a single hypothesis in mind - that the difference between yesterday's students and today's is the difference between B3 (a decade ago) and B4 (today). Note the decline in test score from 90 to 72. Note also the paradoxical increase in cumulative achievement (that would be expressed in the grade point average in college) from 144 to 270 in our illustration.

I conclude from this application of knowledge about motivation to questions of test performance and educational achievement that today's students may be both more able and more highly motivated than any group of students in history. No one can confidently contradict me for the simple reason that ability and motivation have been utterly confounded in test performance and achievement since Binet invented the intelligence test, and today we know more about how motivation influences behavior.

The direction of work in progress having to do with this analysis considers the possibility that the level of performance and time spent in academic work should produce a growth in ability. That would gradually produce a positive correlation between strength of motivation and level of ability (Atkinson, Lens, and O'Malley, 1976). A myriad of new questions concerning the interdependence of ability and motivation arise once we get our semantics straightened out and stop referring to differences in level of intellective test performance by persons who differ in strength of motivation as differences in ability.

If we are to get at those socially significant questions, we must close the gap between the frontier of motivational psychology and educational psychology. Whose responsibility is that?

The first feasible step is to encourage systematic experimental study of how personal and situational determinants of motivation influence the level of intellective performance on the tests traditionally conceived as measures of ability. The test agencies should have been doing this job since their inception.

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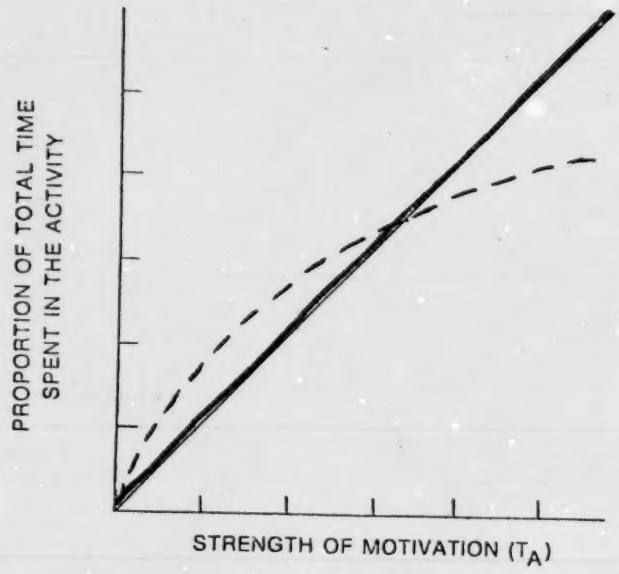

Figure 1
Simplified representation of the effect of strength of motivation for some activity (T_A) on proportion of time spent in the activity. Computer simulations based on current theory show this to be a negatively accelerated function (Atkinson, Bongort, & Price, 1977). Linearity is assumed for simplicity in exposition.

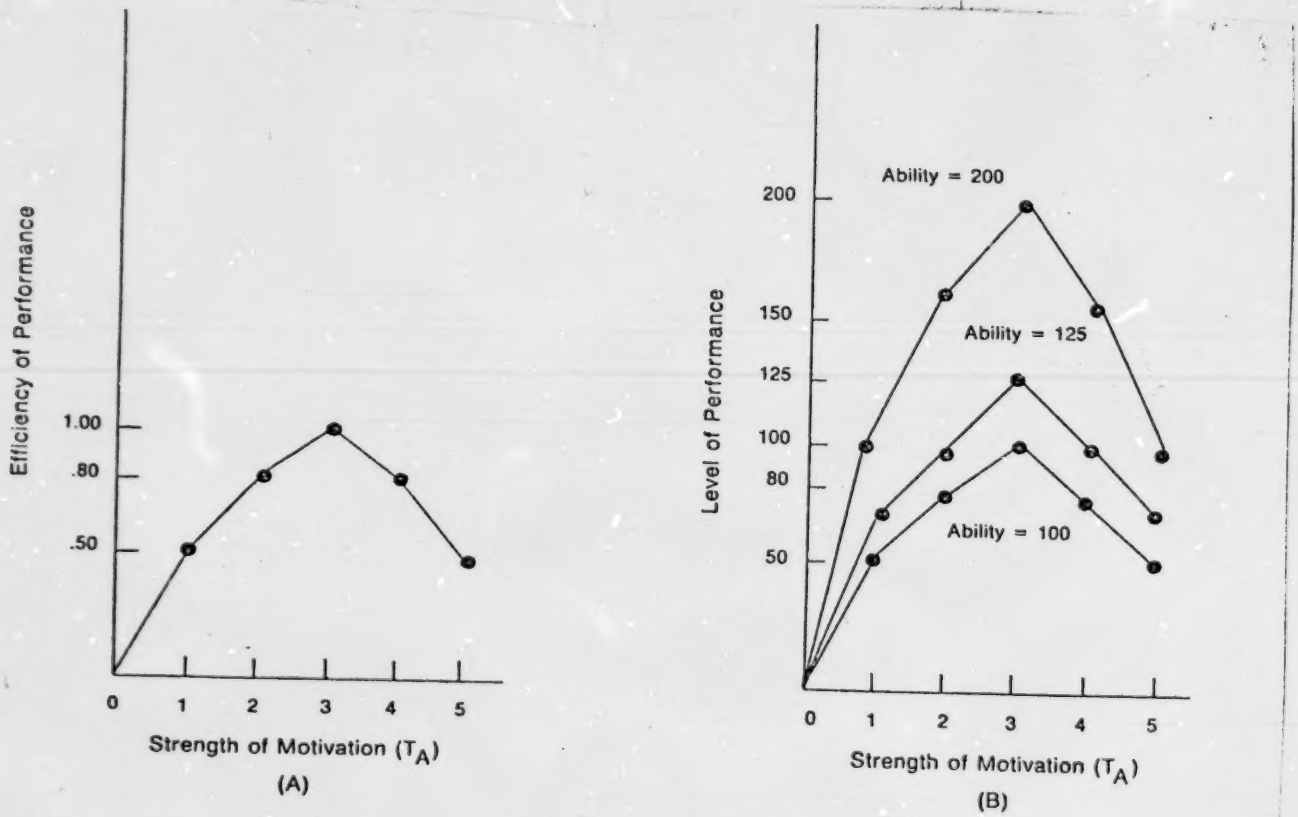

Figure 2
(A) The effect of strength of motivation on efficiency of performance, and (B) the effect of strength of motivation on level of performance when level of performance = ability x efficiency. The overall strength of motivation is a summation of various components such as intrinsic interest, tendencies to achieve, to gain social approval, to avoid failure, to attain distant future objectives (based on Atkinson, 1974a).

TABLE 1

Ability and motivation as determinants of the level of intellective performance and cumulative academic achievement. In this hypothetical numerical illustration it is assumed that all students are more strongly motivated (+1) when taking a test than under normal everyday conditions.

	Ability test situation				*Normal everyday conditions*				
Name of subjecta	True ability	Motivation	Efficiency	Level of test performance	Motivation	Efficiency	Level of performance	× Time spent in work	= Cumulative Achievement
A3	100	3	1.00	100	2	.80	80	2	160
B3	90	3	1.00	90	2	.80	72	2	144
A2	100	2	.80	80	1	.50	50	1	50
A4	100	4	.80	80	3	1.00	100	3	300
C3	80	3	1.00	80	2	.80	64	2	128
B2	90	2	.80	72	1	.50	45	1	45
B4	90	4	.80	72	3	1.00	90	3	270
C2	80	2	.80	64	1	.50	40	1	40
C4	80	4	.80	64	3	1.00	80	3	240

[a]Ss are named according to their true level of ability (A=100, B=90, C=80) and their strength of motivation (T_A) in the ability test situation. (Based on Atkinson, 1974a.)